

July 21, 2006

CALL FOR SUBMISSIONS (CFS)

CFS Number 2006-10

Vehicle-Infrastructure Integration Testbed in the San Francisco Bay Area

NO FUNDS WILL BE AWARDED FROM THIS SOLICITATION. A CONTRACT MAY OR MAY NOT BE AWARDED FROM THIS SOLICITATION.

The California Department of Transportation (Department), in cooperation with the Metropolitan Transportation Commission (MTC), is soliciting participation in the proof of concept test and showcase of a cooperative vehicle-roadway system known as the Vehicle-Infrastructure Integration (VII) Testbed in the San Francisco Bay Area.

This solicitation is part of a program known as VII California. It is intended to identify private sector organizations interested in partnering with the Department and MTC in developing and testing VII in the Bay Area and in helping to inform a statewide and national deployment decision on the future of VII. The Department and MTC plan to partner with private sector organizations that are interested in making private investment in developing and installing the VII infrastructure, including roadside equipment and backhaul communications (roadside-to-center), as well as providing fleets of VII-equipped vehicles. These investments will enable proof of concept testing and showcasing of a variety of VII applications (also referred to as use cases), and will provide important information about design, installation, operation and business model aspects of VII provisioning that will inform national deployment decisions.

The Department and MTC are also currently engaged in discussions with the automobile industry to identify additional participants in VII California and in Bay Area proof of concept testing and showcasing. The desired outcome of these discussions is to have automobile industry vehicles with associated on-board equipment engaged in the VII California Testbed and available for CFS-related projects. With or without auto industry participation, it is anticipated that additional VII-equipped vehicles will be needed and CFS respondents should consider aftermarket products, Bay Area fleet options, or any other means to increase the volume of VII-equipped vehicles.

1. BACKGROUND

The ultimate goals of VII California are to:

- Better manage the safety and productivity of the surface transportation system;
- Combine the resources, expertise, and innovations of the public sector, the auto industry, aftermarket suppliers, and other private sector participants for the benefit of the traveling public;

- Build upon California's already considerable existing infrastructure investments; and
- Create opportunities for innovation in the transportation system, exploring commercial uses of the system to fund its deployment and operation.

Starting in 2005, the VII California partners embarked upon the development of a testbed to understand the technical feasibility and institutional value of VII in order to assess real-world implementations of VII infrastructure, architecture and operations.

Under VII California, proof of concept tests will be conducted in the Bay Area. The Department and MTC will deploy approximately 40 VII RoadSide Equipment (RSE) locations equipped with 5.9 GHz radio units. The vehicles and the infrastructure will communicate with each other using the emerging Dedicated Short Range Communications (DSRC) protocol (see Appendix A, "VII California Concept of Operations" for more information). At present, this testbed is comprised of nine RSEs at locations along US-101 and State Route 82 (El Camino Real), all in the vicinity of Palo Alto (see Appendix B). The balance of the testbed RSEs will be located on US-101, State Route 82, and I-280 (as described in Appendix A). In addition, the testbed may encompass either the San Mateo Bridge or Dumbarton Bridge between US-101 and I-880. The VII California Testbed and equipment that comprises it will be available for use by respondents (see Section 3. "Assets offered by VII California" for details). Other San Francisco Bay Area testbed locations proposed by the respondents will also be considered.

In November of 2005, at the Intelligent Transportation Systems (ITS) World Congress held in San Francisco, a technology demonstration called the Innovative Mobility Showcase (IMS) was conducted. It involved numerous public and private sector participants including VII California. The VII California-related activities within the IMS successfully demonstrated the partnership's innovation and commitment. The Department and MTC would like to build on that success through this new solicitation.

The Department and MTC have identified the following public sector VII use cases as being of priority interest for proof of concept testing:

- (a) Traveler Information** – Traveler information systems provide information that may be relevant to the performance of a traveler's trip, including travel times, incident alerts, road closures, school and work zones and weather conditions. This application involves both collecting probe data from the vehicles and sending traveler information to the vehicle's On-Board Equipment (OBE). The OBE shall send raw location, time, speed and direction information of the vehicle to RoadSide Equipment (RSE), which passes the data along to a central processing center where it is used to create timely and accurate real-time traveler information. Travel times will be provided on a regular recurring basis, and referenced either from landmark to landmark, or between geo-located road positions. Interpretation of travel time data will be left up to the vehicle system developers. Incident information and emergency notifications will use the same

mechanisms as travel time notifications, except that these messages will be generated as soon as they are detected by the operations center.

- (b) Ramp Metering** – This application would enable more efficient freeway management by providing vehicle speed and spacing information to the RSE, allowing for dynamic, smooth on-ramp operation with minimal disruption to the mainline traffic flow. VII probe data will provide detailed vehicle snapshots, including timestamp, weather, vehicle position, speed, braking and acceleration information, as well as the vehicle's trajectory through the ramp and merge area(s) and the aggregated flow profiles of vehicles between ramps on a per-lane basis. From this data, other measures including link travel time and average ramp queue information can also be derived.
- (c) Electronic Payment (Tolling)** – This application involves using VII onboard and roadside equipment in the processing of bridge toll transactions.
- (d) Intersection Safety** – This is the application of low latency, high availability, safety critical messaging between RSEs and OBEs for cooperative intersection safety, with focus on signal violation, dilemma zone warning (to address the onset of yellow signal phase) and reducing left-turn crashes. This family of applications may require high data rate, as wireless map updates may constitute a significant component of the message.
- (e) Curve Overspeed Warning** – Another application of low latency, high availability, safety critical messaging is curve overspeed warning, wherein road curvature (and potentially, road surface condition) would be broadcast by appropriately positioned RSEs to OBEs, and vehicles would combine this information with their dynamic state to provide in-vehicle warning to drivers, if necessary. An extension would be that vehicles that issue curve overspeed warnings would transmit such information to the roadside, enacting a general warning to unequipped vehicles.

The Department and MTC are also supportive of using the testbed to conduct proof of concept tests for commercial applications that are developed and provided by individual automobile companies or other private sector organizations.

2. PURPOSE OF CFS

The Department and MTC see VII as an opportunity to provide significant improvements to the safety and operation of the transportation system, with potentially important societal benefits. However, before the California partners – or the nation – can commit the financial resources and support any companion legislative actions, there needs to be evidence of the feasibility and value of VII. This evidence should be based on proof of concept and field operational testing in a real-world setting. The field testing results should be made available in a timely fashion to inform national VII program decision milestones.

The key strategy is to establish a testbed that will showcase the value of VII in terms of safety and mobility benefits. The urgency of the looming national decision on VII in

2008 makes the concept of a testbed even more important. The viability of the VII California applications will be evaluated by Caltrans, MTC and their contractors. Mobility benefits will be evaluated in terms of user perception of the usefulness of VII-generated traveler information delivered in-vehicle, as well as value provided to the public agencies. With regard to value provided to the agencies, ease of implementation, potential cost savings and additional sources of traveler information will be considered. Additionally, benefits with regard to improved freeway management, efficiencies projected for toll collection, on-ramp metering and flow balancing operations will also be considered. Finally, safety benefits resulting from the intersection and curve overspeed warning applications will be determined and quantified by comparing crash or crash surrogate statistics before and after VII implementation, and/or with intersections or curves that are similar to those that are VII-equipped.

As a note, because the VII California Testbed expressly allows private services to share in the VII network, evaluation of these private services will most likely be qualitative and focus on areas such as ease of coordination and data sharing lessons learned. However, respondents are encouraged to conduct and share their own evaluation results.

This CFS is intended to solicit the participation of partners to invest in and cooperate with the Department and MTC to create a testbed environment in the Bay Area for VII field testing and evaluation. This testbed is needed in order to develop knowledge about VII technical and business model issues that will be vital to inform both state and national decisions about VII viability. The key questions that need to be answered by using this testbed include:

- How can the increased quantity and quality of data from VII be used to enhance public safety, transportation management, traveler information and electronic payment?
- What other user services of interest to the private sector could be implemented on the VII data platform and what would be their market (revenue generation) potential?
- Does the private sector see potential to use VII to generate revenue and profit that would be sufficient to justify an investment in the needed roadside infrastructure and backhaul communications on a statewide and nationwide basis?
- How can some of the technical challenges be addressed? For example:
 - What are the challenges involved in installing, operating and maintaining VII RSEs in the public roadway environments of freeways and urban and suburban arterials?
 - How much data can be downloaded to and uploaded from a vehicle passing a VII RSE, as a function of the RSE communications protocol, the speed of the vehicle, traffic density, and RSE antenna capability?
 - Where are the best RSE installation locations, in a variety of urban and

suburban roadway environments?

- How well can different wireless technologies (such as WiFi, WiMax, HSDPA {High Speed Downlink Packet Access}, etc.) for the vehicle-infrastructure communications link of VII coexist with each other at the same sites?
- What are the technical and economic advantages and disadvantages of alternative technologies for backhaul of data from RSEs to the processing center, for a representative range of urban and suburban RSE installation locations?

The Department and MTC are seeking a broad range of resources and expertise from selected respondents, including:

- The ability to increase the number of VII-equipped vehicles in the testbed by providing and outfitting fleets of vehicles with aftermarket components;
- An investment in and supply of roadside infrastructure consisting of RSEs and backhaul communications;
- The ability to develop or incorporate applications of the use cases identified above, as well as others of interest to the respondent;
- The resources to produce an operational testbed in time to inform a national decision regarding VII viability in 2008;
- Expertise in System engineering and integration; and
- Expertise in a variety of other technical areas, such as:
 - Wireless communications hardware and software
 - Wireless propagation in urban environments
 - Communication networking hardware and software
 - Applications software development

3. ASSETS OFFERED BY VII CALIFORNIA

No public funding for CFS respondents is available at this time. CFS respondents are expected to offer an investment in the VII California Testbed in the form of equipment, software, labor, travel and other direct costs. The Department and MTC continue to actively pursue opportunities for public funding to support the VII California programs which, depending on identified needs, could include CFS projects.

The Department, MTC and other partners intend to offer the assets described below to a successful CFS respondent in order to enable delivery of the VII California Testbed project. In return, participants would be required to provide the Department, MTC and other partners access to all data from the testbed that enables provision of VII services. For example, the Department and MTC will require access to all vehicle probe data,

including position, speed and heading of each VII-equipped vehicle, as well as vehicle diagnostic information. Data collected from this project will be used to support an evaluation of the potential benefits of VII deployment.

The Department, MTC and other partners plan to offer the following assets to the CFS respondents:

- (a) Existing partnership and commitment
- (b) Access to State or local facilities
- (c) Access to existing VII California equipment and systems
- (d) Access to standardized message sets and protocols

A. Existing Partnership and Commitment

The Department, MTC and the other VII California partners are committed to the success of the testbed. While no formal partnership agreement currently exists, the VII California partners have adopted the following roles and responsibilities with respect to the Program:

- As owner and operator of the state transportation system, the Department is leading the development of roadside infrastructure and serving as overall project manager. The Department has contracted with the California PATH (California Partners for Advanced Transit and Highways) Program to develop the existing RSEs, including vehicle-to-infrastructure messaging and communication of the VII data at the roadside. See Appendix B for a list of RSE locations.
- As a regional agency with various operational responsibilities, MTC operates several system management tools, such as the region's 511 traveler information system and the Fastrak™ electronic toll collection system. MTC serves as facilitator/coordinator with local agencies, and is leading the efforts in back end processing, backhaul communications and development of traveler information applications for the VII California Testbed. MTC has contracted with PB Farradyne to design backhaul communications and handle data collection, processing and archiving.
- As owners of the vehicles and on-board equipment (OBE), DaimlerChrysler Research & Technology NA, Inc., Volkswagen of America, and Toyota InfoTechnology Center USA are leading the development of OBE devices and are responsible for providing test vehicles to the testbed.

The Department and MTC have each committed \$1.5 million to support the VII California Program, the existing testbed, and to provide continued support for forthcoming projects from the CFS. A portion of this money has already been spent building out Phase 1 of the program, which culminated in a successful demonstration at the ITS World Congress last November in San Francisco. The Department and MTC intend to spend the remainder of these committed funds on Phase 2 of VII California. This will cover the period 2006-2008, building on what was learned in the first phase.

This phase will require a more formal evaluation, culminating in a decision by the VII California partners to either recommend or not recommend a national VII deployment as being feasible. The remainder of the funds will be spent on testbed related activities conducted outside of the CFS agreement such as the evaluation, infrastructure build-out, development of public sector use cases, or project management.

B. Access to State or Local Facilities

The Department, MTC and other partners will provide access to State- or locally-owned facilities based on identified need. These facilities may include right of way, cabinets, call boxes, light poles, traffic signal controllers, ramp meters, electrical service, or telecommunications assets. Access to these resources will be determined on a case-by-case basis. Use of State or local facilities may be subject to successful application for an encroachment permit issuance, and any other applicable statutes and regulations. Issuance of these permits will be expedited as much as possible in order to meet the VII California project schedule.

C. Access to Existing VII California Equipment and Systems

The VII California Program has already purchased and installed roadside equipment in the field and developed a number of VII applications during Phase 1 of the project. The CFS respondents will be permitted to use these existing VII California assets for delivery of the VII California Testbed project. The CFS respondents will also be given access to existing VII California software applications and related documentation developed in Phase 1 for delivery of the project. Finally, MTC will make its 511 system and FasTrak toll collection system available to respondents for developing VII applications related to traveler information and electronic toll collection, respectively.

D. Access to Standardized Message Sets and Protocols

The VII California Testbed has well-defined message sets and network layer protocols. The message sets are based upon the emerging SAE (Society of Automotive Engineers) 2735 standards work, and VII California will continue to track them in order for testbed products to have maximum interoperability with other VII developments nationwide. Additionally, VII California currently has a network layer scheme that worked well with the IMS (see Appendix A.). Responses that are compatible with existing VII California message set definitions and improve upon the current network architecture are encouraged.

4. AREAS OF INTEREST

The Department and MTC are interested in developing VII in the San Francisco Bay Area in order to:

- Evaluate public use cases from which we can generalize VII feasibility for improving transportation management and enhancing safety;
- Evaluate institutional, policy and public benefit issues;

- Explore wireless communication deployment issues and options;
- Resolve key technical issues involving implementation and operations;
- Assess implementations of the VII infrastructure, architecture and operations; and
- Support evaluation of public and private applications.

Use cases could include – but are not limited to – the VII use cases described in the Background section above.

With respect to this CFS solicitation, the Department and MTC are specifically interested in responses that combine multiple capabilities, technological alternatives, and user services to provide representative VII implementations. Organizations interested in responding to the CFS may decide to team with others, if needed, to provide turnkey end-to-end VII use case solutions supported by the assets that the Department and MTC have committed in Section 3 of this CFS document.

Areas of interest for this CFS include, but are not limited to:

- **Provision of fleets / aftermarket components.** The Department and MTC are interested in increasing the number of vehicles in the testbed by having the respondents provide and outfit fleets of vehicles to interact with the VII California testbed. In-vehicle equipment should communicate wirelessly with RSEs (see “Communication Technologies” below) and may interact with the vehicle’s On-Board Diagnostics II (OBD II) interface to provide VII services (see “applications” below).
- **RoadSide Equipment (RSE).** The Department and MTC are interested in increasing the number of RSE locations in the testbed by having respondents provide RSEs, processors and the associated environmental packaging. This includes expansion of the baseline network of up to 40 RSEs to other sites.
- **Backhaul communications.** The Department and MTC are interested in increasing the bandwidth of the backhaul communications link between the RSEs and the processing center. Note that DSRC radios are intended to have a data rate of 6Mb/sec, which would require a significant companion data rate for backhaul. Solutions that provide a data rate of between 1Mb/sec and 6Mb/sec are sought.
- **Applications.** The Department and MTC are seeking respondents to develop “use case” applications and provide applications support, from both the list of public sector use cases identified in the Background section and others that are of interest to the respondents. This may also include services that support the VII network from local safety components through “back office” processing operations. Such services include data aggregation and processing methods, registration, and considerations of security and privacy. Respondents should note that some applications development is already being conducted by the VII California partnership in areas of traveler information, intersection safety and curve overspeed warning. The Department and MTC are seeking respondents

that will support this ongoing work and initiate applications development in new areas.

- **Communication technologies.** The Department and MTC are interested in respondents that can support deployment of different communications technologies, such as vehicle and onboard equipment to include after-market devices, Dedicated Short Range Communications (DSRC) transceivers or other wireless means (e.g., WiFi, WiMax).
- **Business case development.** The Department and MTC are interested in having respondents to help identify potential business cases to support deployment of all the above areas. This includes identification of viable business models that would generate revenue streams sufficient to justify private investment in the deployment, operation, and maintenance of VII infrastructure.
- **Institutional issues.** The Department and MTC are seeking insight on key institutional issues, such as privacy, liability and data ownership and access issues.

The governing principles for participation in the VII California testbed include:

- Recognizing that the VII National Architecture is rapidly evolving, respondents cannot be expected to comply with it completely. However, respondents are expected to follow the fundamental principles of the VII national architecture so that the results of the VII California testing and evaluation can contribute to the state and national deployment decisions. In order to encourage the identification of new and potentially better alternatives, deviations from the VII national architecture are not prohibited, but any significant deviations should be explained and justified in the submission. Version 1.1 of the VII National Architecture can be found at the following location: <http://www.vehicle-infrastructure.org/>
- An agreed-upon set of data shall be made available to the Department and MTC testbed evaluators to support their evaluations of the VII technologies and services.
- Respondents must be willing to participate in public demonstrations of their systems, as mutually agreed upon with the Department and MTC.

5. SUBMISSION REQUIREMENTS

A. Cover/Transmittal Letter and Proposal Format

1. The proposal submittal shall be transmitted with a cover letter signed by a party authorized to represent the company or partner companies.
2. The cover letter must contain the following information:
 - (a) The project title;
 - (b) The name of the entity submitting the proposal;
 - (c) The name of all project partners; and
 - (d) The system or technology to be implemented and desired location.

3. The cover letter shall provide the name, title, address, and telephone number of individuals with authority to negotiate and contractually bind the submitting organization. The transmittal letter shall contain a statement by the respondent that they will comply with State and Federal nondiscrimination requirements. An unsigned proposal or one signed by an individual not authorized to bind the respondent will be rejected. However, the selection by the Department, MTC and/or partner agencies will not be binding until an Agreement has been executed and approved by the Department and MTC.
4. The respondent's proposal should include the following sections, at a minimum:
 - Cover Letter
 - Project Plan
 - Team Qualifications
 - Relevant Experience
 - References (3 minimum)
5. A Table of Contents and List of Exhibits shall indicate the page number of each section and exhibit.
6. Proposals shall not exceed 30 pages. Additional information may be requested later.
7. The following information must be placed on the lower left corner of the submittal shipping package:
 - CFS#
 - Project Title
 - Respondent's/ Name/Firm
 - Attention: Hassan Aboukhadijeh
 - DO NOT OPEN

Submissions may be either mailed or delivered by hand to the address noted in Section F below. Submissions may not be sent by fax machine. Submissions are not to be sent to other Department or MTC offices and will not be returned to the respondent.

B. Project Plan

Respondents must submit a project plan that:

- Describes the operational concept of the system or technology being offered. The plan shall include a description of the use case applications to be supported by the proposed system.
- Identifies the resources the respondent intends to provide to support the project (financial, hardware, software and personnel).
- Defines the responsibilities of each participant on the respondent team, both technical and financial.

- Describes the proposed relationship between the respondent team and the Department, MTC and other public sector agencies or contractors in the development and operation of the project.
- Shows an organization chart that depicts the proposed roles of each public and private sector entity involved in the project.
- If applicable, describes the type of work to be done on State or local facilities, along with the type of access needed to State or local facilities.
- Provides a proposed timeline for system development, testing, and operations.
- Includes a statement about how the proposed project will help inform a decision about VII viability.

C. Management and Financial Qualifications of Proposer

The qualifications and experience of each of the participating organizations and key management personnel must be described. Submissions should demonstrate that the respondent understands that he/ she will be solely responsible for funding the project for the specified pilot demonstration and will provide the necessary insurance, if applicable.

D. Relevant Experience

Proposals should describe the respondents' experience in developing, implementing and operating systems/facilities similar to those being considered for this project. Respondents should include their experience working on comparable public/private joint development projects or public activities service operations. They should also include relevant project management experience for projects with a high level of complexity involving numerous public and private sector partners.

E. Questions and Answers

Respondents with questions about the requirements of the final published CFS must submit those questions by e-mail to **Greg Larson** of the Department at greg.larson@dot.ca.gov. Questions submitted must include the individual's name and e-mail address, and the name and address of the firm. All questions on the final CFS must be received no later than August 4, 2006. Answers will be posted electronically before August 11, 2006.

After the deadline for question submittal has passed, responses to questions will be collectively compiled, and e-mailed as an Addendum, to each individual or firm who downloads this CFS from the Internet or who requests this CFS by calling the recorded bid line: (916) 227-6090. A hard copy of written responses will be provided upon request, and an electronic version will be uploaded to the Department's website (see web link below) and the VII California website. Refer to Section 7, Schedule, to get the schedule of events and dates. It is the responsibility of the respondent to inquire about any potential Addendum. Respondents can contact the contact person named above or check the Department's website:

<http://www.caltrans-opac.ca.gov/contract.htm>

F. Proposal Submittal, Modification, and Withdrawal

Respondents are required to submit an original proposal marked “ORIGINAL“, and seven (7) copies of the proposal to:

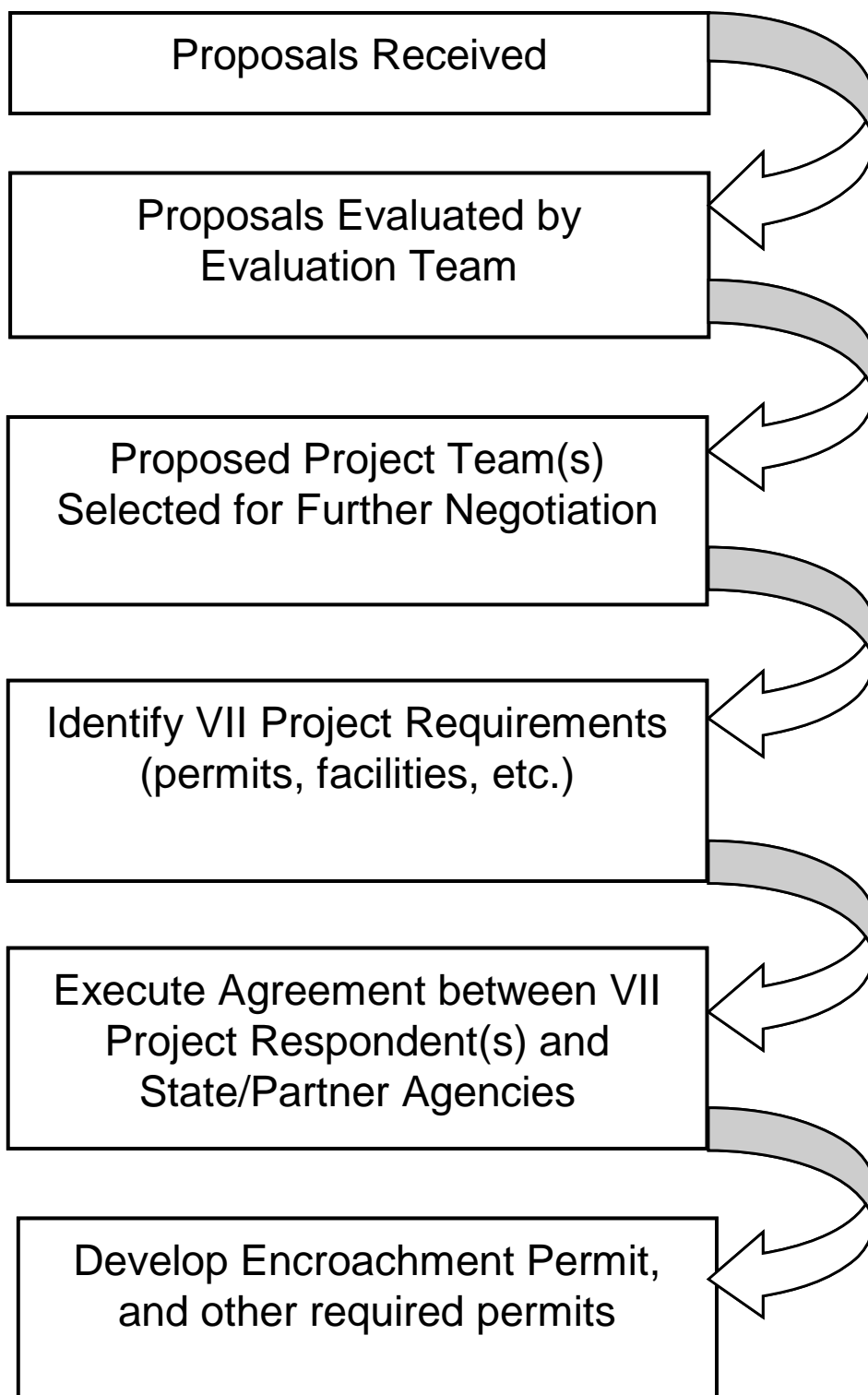
**Greg Larson
Department of Transportation
Division of Research and Innovation, MS-83
P.O. Box 942873
Sacramento, CA 94273**

Respondents submitting proposals may modify or withdraw the proposal at any time prior to the submittal deadline. Such modification or withdrawal of a proposal shall be in writing and signed by the same person signing the original proposal.

If the modification requested is only an addition to a proposal, seven (7) copies of the modification shall be submitted in a sealed package, boldly marked “Addition To (project title)”, and signed, and addressed the same as the original proposal.

The following flowchart identifies the key steps in the CFS process.

CFS Process



6. PROPOSAL ACCEPTANCE AND EVALUATION

A. Evaluation Process

The Evaluation Team will consist of representatives from the Department, MTC and local or regional agencies, and technical experts. Submissions will be screened to ensure that they meet the minimum requirements set forth in Section 5 above. Submissions that meet the minimum requirements will be evaluated against the evaluation criteria listed below. Submissions that meet the requirements and are selected based on the evaluation criteria will move into a project negotiation phase, which will include all requisite agencies and submitting parties to finalize the details of the project and develop an agreement among the project partners. Multiple awards may result from this CFS; however, it is unlikely that more than two awards will be given.

The Department and/or partners will not reimburse submitting organizations for any costs incurred in the preparation or submission of Proposals, or the negotiation process, or the implementation of any projects.

B. Acceptance and Rejection of Submissions

The Department and/or its partners reserve the right to accept proposals that, in the sole judgment of the Department and/or its partners are in the best interest of the State and regions. The Department and/or its partners reserve the right to reject any or all proposals, or to modify or cancel, in part or in its entirety, this CFS.

The Department and/or its partners retain the right to disregard a minor deviation from the requirements and may, at its sole discretion, request supplemental information or clarification of the information submitted.

C. Evaluation Criteria

The following criteria will be used to evaluate proposals that meet the basic submission requirements set forth in the CFS. Please note the weighting assigned to each of the evaluation criteria.

1. **Ability to inform the VII decision (30%).** The Evaluation Team will judge the ability of the proposed project to provide tangible results that will help inform a decision about VII viability.
2. **Utility of VII Applications (20%).** The Evaluation Team will judge the ability of the respondent to develop or support development of the five public sector use case applications described in the Background section of this CFS. These five use cases will be given equal weight during the evaluation. In addition, evaluators will determine the usefulness of any additional use case applications proposed, but higher importance will be placed on the public sector use cases.

3. **Level of Commitment (15%).** The Evaluation Team will judge the level of commitment of the respondent as demonstrated by the resources (financial, hardware, software and personnel) offered.
4. **Technical Approach (15%).** The Evaluation Team will judge the technical approach described in the project plan, including its innovativeness and technical feasibility.
5. **Project Management (10%).** The Evaluation Team will judge the feasibility of the proposed project management approach, including schedule, organizational and institutional considerations. Respondents should demonstrate how their proposed pilot project can be implemented by June 1, 2007.
6. **Relevant Experience (10%).** The Evaluation Team will judge the experience of the respondent and respondent team in successfully deploying technology in a public/private cooperative environment. Respondents will be evaluated based on their relevant past technical and project management experience.

D. Negotiations with Selected Proposer

This CFS shall not commit the Department and/or its partners to negotiate and execute any Agreement. The Department and/or its partners may elect to negotiate with the selected respondents, leading to a written Agreement with the Department and/or one of its partners about implementing the submission. Any agreement as a result of this CFS will be subject to all necessary Local, State, and Federal approvals. If an agreement cannot be reached, negotiations will cease and no contractual agreement written or implied will exist. The Department and/or its partners reserve the right to reject any proposal for non-compliance.

Selected respondent(s), shall, within ten (10) calendar days after receiving written notification of selection, meet with the Department and/or its partners to begin negotiating the Agreement, application for an encroachment permit (if appropriate), and compliance with applicable federal and state statutes and regulations. The Department and/or its partners will negotiate with the selected respondents on the length of the pilot project term and its evaluation. A sunset date for the pilot project demonstration and evaluation will be included in the Agreement.

It is expected that the final CFS will require that within thirty (30) calendar days from the successful conclusion of negotiations, the selected respondent(s) shall execute and deliver to the Department six (6) signed copies of the final negotiated Agreement. The negotiated final Agreement shall be on forms provided by the Department. The successful respondent shall also furnish proof, satisfactory to the Department, of the authority of the person or persons executing the Agreement.

E. Public Safety

Proposals requiring work on or use of State or local facilities shall be in conformance with the requisite agency's construction and safety policies, guidelines and standards. Any hardware, equipment and/or software will be removed as necessary at the direction

of the Department and/or its partners that own the facility in which the equipment or software was installed.

G. Indemnification and Insurance

The selected respondents shall defend, indemnify, and hold harmless the State of California, its partners, agents, affiliates and its employees from and against any and all liability, loss, expense (including reasonable attorneys' fees), or claims for injury or damages arising from the performance of work resulting from this CFS. This indemnification shall be included in the Agreement negotiated between the selected respondents and the Department and/or its partners.

The selected respondents shall, at their own expense, obtain and maintain in effect at all times during the life of the Agreement insurance against all claims, damages, and losses due to injuries to persons or damage to property that may arise during the performance of their work.

H. Intellectual Property Rights/Proprietary Rights

All issues regarding intellectual property rights, including, but not limited to, patents, copyrights, trademarks, collective trade marks, collective membership marks, certification marks and service marks shall remain the responsibility of those submitting proposals.

I. Confidentiality

Evaluation Team members shall not discuss any aspect of the evaluation proceedings or content of proposals with anyone not designated as a selection committee member or Chairperson for this CFS.

Generally, at the time any submission is opened, it becomes public information. There is an exception for proprietary information/trade secrets in the California Public Records Act (Government Code sections 6250 et. seq.). If desired, respondents should make this claim at the time the submission is sent. The Department shall not disclose any information that is claimed as privileged, unless such disclosure is required by law. Persons submitting a proposal should confer with their own legal counsel to determine whether any information claimed as privileged is in fact protected as privileged.

J. Amendments to the CFS

The Department and partners reserve the right to amend this CFS by addendum prior to the final date of proposal submission.

7. SCHEDULE

ACTIVITY	DATE
1. CFS published to solicit proposal development	7/21/2006
2. Written Questions on CFS Due	8/04/2006
3. Answers to CFS Questions Provided	8/11/2006
4. CFS Proposals Due	9/30/2006
5. CFS Selection and Notification (tentative)	10/27/2006
6. Anticipated Completion of Negotiation/Contract Award (tentative)	12/15/2006

Appendix A

VII California **Concept of Operations**

A Collaboration of Metropolitan Transportation Commission (MTC),
Caltrans, DaimlerChrysler and Volkswagen/Audi

University of California Partners for Advanced Transit and Highways (Caltrans) and Parsons-
Brinkerhoff Farradyne (MTC), Contractors

July 21, 2005

VII California Concept of Operations

This document describes the Concept of Operations (ConOps) for *VII California* in eight parts:

1. Goals
2. Use Cases
3. Architecture
4. Vehicle-Roadside Component
5. Roadside Component
6. Roadside-Center(s) Component
7. Processing and Archiving
8. Evaluation Plan

It is written at high level and is a first version of an iterative process where multiple stakeholders – developers and users alike – can describe expectations of the target *VII California* system in terms that need not be quantifiable and testable. This document will be used as input to the development of *VII California* requirements, then specifications.

The *VII California* testbed and proof of concept development is a joint Metropolitan Transportation Commission (MTC), Caltrans, DaimlerChrysler and Volkswagen/Audi activity. Multiple collaborating partners are further sought as co-developers and, ultimately, “owners.” In the current work, California PATH will be working with Caltrans on the infrastructure (roadside unit) implementation and vehicle-infrastructure messaging and communication of the VII data, whereas PB Farradyne will be working with MTC on backhaul communications and collection, processing and archiving of data at the center.

1.0 Goals¹

As documented in the *VII California White Paper* and *VII California Program Plan Outline*, the overall goals of the *VII California* program are to:

- Better manage the safety and productivity of the surface transportation system;
- Benefit from the synergy of public sector, auto industry, and other private sector innovations; and
- Build upon California’s already considerable existing infrastructure investments.

While these goals are appropriate for the overall VII California Program, the VII California Working Group has established more tangible, near-term goals for the VII testbed. These include:

- Provide a testbed to understand the technical feasibility and institutional value of VII;
- Inform future decisions for the National VII Program;

¹ Obtained from pp. 6 – 8 of *VII California Development and Deployment* program plan.

- Inform future decisions for California and Bay Area System Management Programs; and
- Assess real-world implementations of VII infrastructure, architecture and operations.

The development period of *VII California* is currently through 2007 over which time both the overarching goals and the testbed goals will be realized. The VII California Working Group plans to develop the testbed in three phases: Initial Development, World Congress Demonstration, and VII Proof of Concept. Specific tasks and durations within these phases are provided in the timeline given in Figure 1-1.

Figure 1-1. VII California Schedule

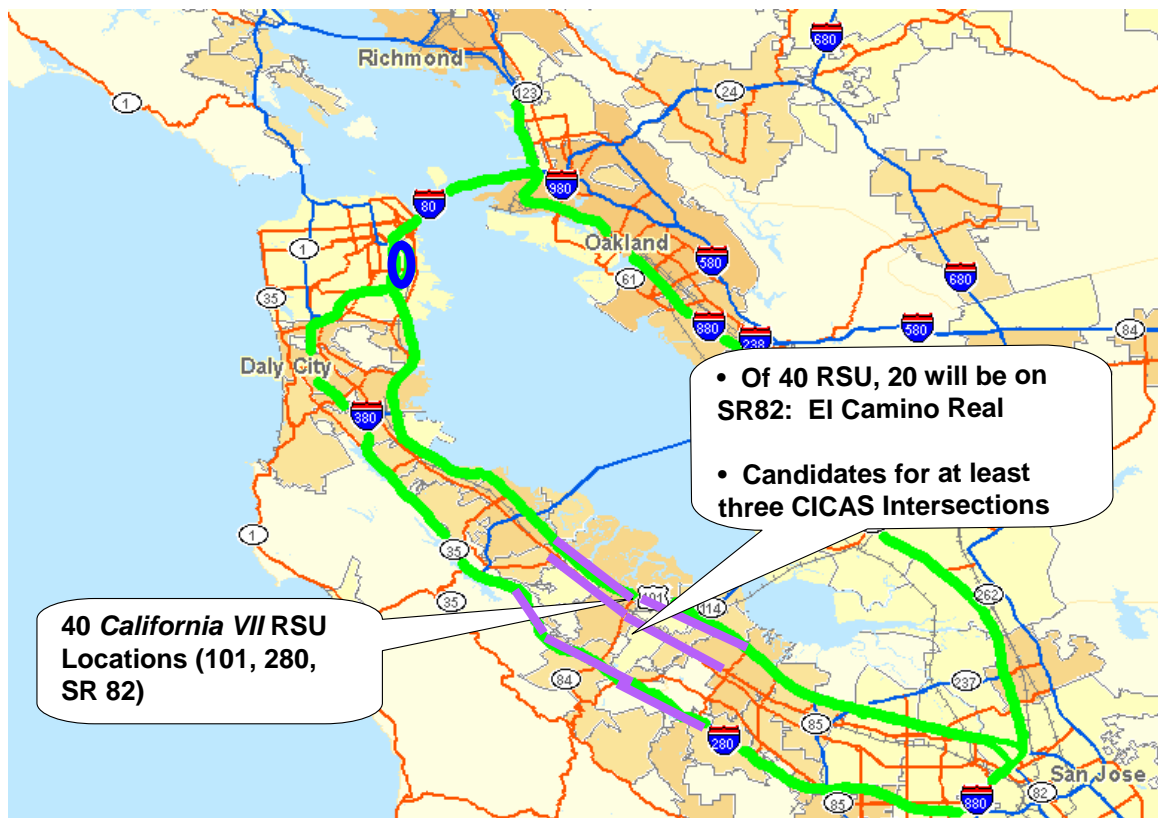
Task	Task Name	Start	Finish	2004		2005				2006				2007			
				Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 0	Project Management	July '04	Dec '07														
Phase 1	Initial Development																
Task 1.1	Develop High-Level VIIC Master Plan	July '04	Dec '04														
Task 1.2	Produce VIIC Vision	July '04	Dec '04														
Task 1.3	Develop VIIC Concept of Operations	Mar '05	May '05														
Task 1.4	Derive VIIC Requirements	Apr '05	Jun '06														
Phase 2	WC Demonstration																
Task 2.1	Conduct WC Detailed Design	Apr '05	Jun '06														
Task 2.1.1	Vehicle-RSU Design	Apr '05	Jun '06														
Task 2.1.2	RSU-Center Design	Apr '05	Jun '06														
Task 2.2	Develop and Install WC Elements	May '05	Sep '05														
Task 2.2.1	Develop and Install Vehicle-RSU Apps	May '05	Sep '05														
Task 2.2.2	Develop and Install RSU-Center Apps	Jul '05	Sep '05														
Task 2.3	Test Individual WC Use Cases	Sep '05	Oct '05														
Task 2.4	Conduct WC Demonstration	Nov '05	Nov '05														
Task 2.5	Evaluate WC Demonstration	Mar '06	Mar '06														
Phase 3	VII Proof of Concept																
Task 3.1	Conduct Detailed Design	Jun '06	Sep '06														
Task 3.2	Develop and Install Elements	Sep '06	Mar '07														
Task 3.3	Conduct Component Testing	Apr '07	May '07														
Task 3.4	Conduct System Testing	May '07	Jun '07														
Task 3.5	Evaluate Proof of Concept	Jul '07	Dec '07														
Task 3.6	Operate and Maintain VII Test Bed	Jul '07	?														

To support the VII California Program goals, the first milestone for *VII California* will be to provide up to 40 roadside units (RSU) along Caltrans-operated routes in the San Francisco peninsula, at or near Palo Alto: US-101, US-280 and El Camino Real (SR 82), shown in Figure 1-2. The objectives of this first substantial *VII California* activity are to:

- Demonstrate and outreach emerging *VII California* testbed: give notice that Caltrans, MTC and partners are committed to the concept and will objectively investigate its potential;
- Gain experience in VII and use case development and deployment; and
- Develop and promote the *VII California* public-private partnership.

It is understood that any of these goals may be revisited and revised during the course of the *VII California* demonstration period.

Figure 1-2. Potential RSU Cabinet Locations



2.0 Use Cases²

The first step in developing the Concept of Operations will be to determine appropriate use cases for both the longer-term testbed and, of more immediate consequence, for the World Congress milestone.

Longer-term use cases will be drawn from those briefly described below:

1. **Vehicles as Traffic Probes** – The vehicles shall send raw location, time, speed and direction information to roadside units (RSU) which will pass the raw data along to a central processing center where it will be used to create timely and accurate real-time traveler information. The central processing center would be the 511/TravInfo™ system. The traveler information shall be disseminated to the Caltrans District 4 TMC and to the public via the 511/TravInfo™ system.
2. **Intelligent On-Ramp Metering** – This application involves using wireless-equipped vehicles to measure real-time traffic density on the highway so that on-ramp signal phasing can be dynamically adjusted to maximize mainline traffic flow.
3. **Vehicle Probes Provide Weather Data** – The vehicles provide location and direction information, along with the status of on-board sensors (temperature, precipitation, sun, level, traction control, etc.) and the status of on-board devices (headlights, wipers, heater, air conditioner, etc.) to the central processing center so it can determine the real-time weather conditions on the roadway.
4. **Travel Time Data to Vehicles** – The central processing center sends accurate and up-to-date link travel times to the RSU and then the vehicle for use in real-time dynamic routing. The travel times will be generated by the 511/TravInfo™ system.
5. **Incident Information to Vehicles** - The central processing center transmits real-time incident information to the RSU and then the vehicle, which can be programmed to present this information to the driver in accordance with installed equipment and selected options. The incident information will originate from the 511/TravInfo™ system.
6. **In-Vehicle Signage** – In-vehicle signing refers to the display (and annunciation, where necessary) of available roadside sign information inside the vehicle. This information would be transmitted via RSUs. The information can describe features about the local area such as speed limits or services that are provided in the near vicinity.
7. **Work Zone Safety Warning** - Work zone safety warning refers to the detection of a vehicle in an active work zone area and the indication of a warning to its driver. RSUs would broadcast the warning data to vehicles as they approach a work zone or construction zone.
8. **Intersection Collision Warning** – This is the application of safety critical messaging between vehicles and roadside equipment for cooperative intersection safety, focused on signal violation and left-turn crashes. Such an application would likely require low latency communications concepts such as the 5.9 GHz-dedicated short-range communications (DSRC). This potential use case differs from the others because the implementation envisioned under *VII California* may be prototypical.

² Obtained from pp. 6 – 8 of *VII California Development and Deployment* program plan.

9. **Curve Overspeed Warning** – Another application of low latency safety critical messaging would be curve overspeed warning, wherein road curvature (and potentially, road surface condition) would be broadcast to vehicles, and vehicles would combine this information with their dynamic state to provide in-vehicle warning and, as desired, correction. An extension would be that vehicles that issue curve overspeed alerts would transmit such information to the roadside, enacting a general warning to unequipped vehicles.

It is possible that some of the use cases above may be combined into a single application, e.g., in-vehicle signage may also include work zone warnings or incident information. Moreover, the above list may be refined as more input is received from car manufacturer stakeholders.

Through *VII California* Working Group meetings, six use cases have been selected for the VII deployment aimed at the World Congress milestone. The six demonstrated use cases are a subset of the above, namely:

1. **Vehicles as Traffic Probes** – Data from vehicles is sent to the central processing center and used to calculate travel times along specified links, routes or paths.
2. **Travel Time Data to Vehicles** – The central processing center sends accurate and up-to-date link travel times to the RSU and then the vehicle for use in real-time dynamic routing. The travel times will be generated by the 511/TravInfo™ system.
3. **Incident Information to Vehicles** - The central processing center transmits real-time incident information to the RSU and then the vehicle, which can be programmed to present this information to the driver in accordance with installed equipment and selected options. The incident information will originate from the 511/TravInfo™ system.
4. **Intersection Collision Warning** – The local signal controller transmits signal timing (phase condition) information to the RSU and then the vehicle.
5. **In-Vehicle Signage** – Integration of roadside signage information into in-vehicle navigation system, e.g., speed limit, next exit information. Lays migration path to work zone warning.
6. **OEM Specific Application** – Encrypted message set specific to Original Equipment Manufacturer (OEM) requirements, passed between vehicle, RSU and OEM center.

3.0 Architecture

The *VII California* architecture will be a framework that depicts how information needed to enable a variety of use cases will flow between vehicles and TMCs, vehicle OEMs and other commercial locations, and how that information will be processed, stored and used for operational and evaluation purposes once it is received.

The *VII California* testbed architecture will evolve over time. Because California intends to be an early implementer of the national VII system, the ultimate architecture that supports actual operations will be the one adopted by the national VII Working Group. Version 1.0 of this national VII architecture was published in April, 2005 and will be the subject of continuing thorough review and discussion by public and private sector representatives, and testing and refinement leading to later versions, before adoption.

The *VII California* architecture will be an open architecture that will be designed to enable the testing of various technologies and subsystems, the integration of these technologies and subsystems, and various commercial and governmental applications. Key national activities, such as the development of prototype, standards-compliant DSRC roadside units by the DSRC Industry Consortium, various commercial wireless communications developments, and the implementation of backhaul communications technologies to meet VII requirements, will be closely monitored. The *VII California* architecture will be developed such that it can grow over time to accommodate these and other developments.

The initial architecture shown in Figure 3-1 is the one that will be implemented for the 2005 World Congress. For expediency, a number of elements or features of Version 1.0 of the national VII architecture will not be included in the initial architecture.

WC Demo VII Architecture – Physical Entities

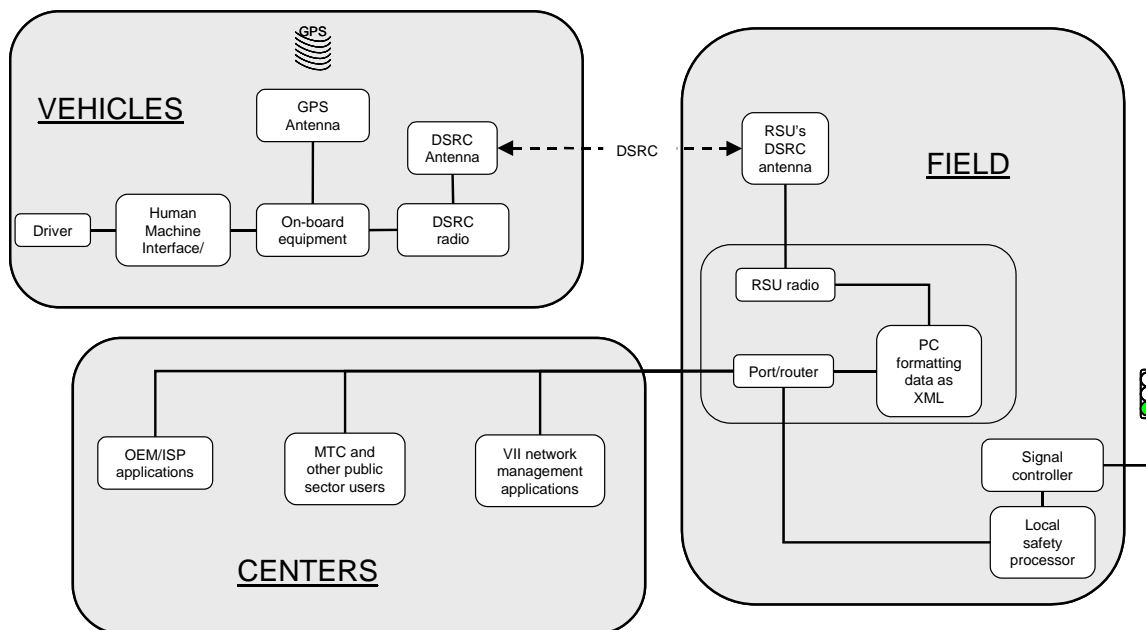


Figure 3-1 VII California World Congress Demo Architecture

As described more fully below, the initial *VII California* architecture will enable the communication of data from equipment located on-board participating vehicles to roadside units deployed at selected locations. From there, the data will be communicated to several locations, including the 511/TravInfo[®] Travel Information Center, and to OEM processing centers, through a router and the appropriate addressing schemes. Data from the 511/TravInfo[®] TIC and the OEM locations will also be communicated back to the roadside units, through them to the participating vehicle on-board equipment, and then provided to the driver through audio or visual displays.

4.0 Vehicle-Roadside Component

Development and installation of the onboard equipment (OBE) system and components are the responsibility of car company stakeholders. At this writing, the OBE system is notionally given, and further definition and correction as necessary will be included in subsequent iterations.

Per Figure 3-1, the vehicle has its onboard equipment suite, consisting of a driver, driver-vehicle interface, a suite of equipment comprising the OBE, and other VII positioning and communications components.

The vehicle positioning and time synchronization will be done through an onboard global positioning system (GPS) unit, which will include a coaxial antenna connector. The positioning requirements from use cases, e.g., “WhichLane”, may predicate whether companion roadside equipment is needed, e.g., local differential correction, Wide Area Augmentation System (WASS) or use of High Accuracy Nationwide Differential GPS (HA NDGPS).

For the OBE’s, the basic communication system is a DSRC Wireless Access in Vehicle Environments (WAVE) radio, hereafter defined as a Wave Radio Module (WRM).

To ensure compatibility with the OEM’s test radios for the OBEs, Caltrans has purchased and will install 50 WRM’s developed by the Collision Avoidance Metrics Partnership (CAMP) and Denso. While the Denso WRM do not map completely into the emerging DSRC 802.11p standard, they will be the VII California standard radios through at least the World Congress demonstration.

Outside the WRM and antenna, the OBE will also include other potential principal components:

- DSRC amp and antenna
 - MCX coaxial DSRC antenna connector
- Other wireless transceivers: radio card plus amp and antenna (e.g., 802.11b/g)
 - MCX coaxial 802.11b/g antenna
- GPS for positioning and UTC time synchronization
 - Including MCX coaxial GPS antenna connector
- OBE processing equipment and software
- Power
 - 110 Volt power
 - AC to DC power supply
- Connection point for ground
- Separate enclosure (potential)

The above list of components is not complete and needs further definition from car OEM stakeholders, currently DaimlerChrysler and Volkswagen/Audi.

The on-board equipment will assemble information from various sensors inside the participating vehicles and communicate this information to the roadside. The information that will be communicated will be that set of information that meets the requirements of the selected World Congress use cases, as well as the needs of the participating OEMs. For the Vehicles as Probes use case, the following information will be needed:

- Vehicle ID
- Location(s)
- Heading(s)
- Time(s)
- Speed(s)

The information sent by the vehicles to the roadside unit will be in the form of a message or block that will contain the above data, as well as data of proprietary interest to the participating OEMs. The roadside unit will send each block of data received to a router which will transmit each block to its intended destinations, including the 511/TravInfo[®] TIC. In order to protect its proprietary interests, each participating OEM will encrypt its proprietary data and provide a unique identifier such that this data goes only to it and the 511/TravInfo[®] TIC, and so that the proprietary data cannot be read at the 511/TravInfo[®] TIC. For the World Congress demo, OEMs will manage data security needs for the OEM specific message sets. Security for non-OEM data will not be implemented but will be evaluated for the subsequent testbed infrastructure and implemented accordingly.

In addition, the OBE will receive travel time and incident information sent from 511/TravInfo[™] through the roadside unit and provide it to the driver through either an audio or visual display. Message set definition including site specific broadcast parameters will be developed during the requirements and detailed design stages of the California VII program.

5.0 Roadside Component

5.1 Hardware

Part of Figure 3-1 is an architectural configuration of roadside equipment (RSE), which will be developed prior to the World Congress but are intended for use for *VII California* past that milestone. At the heart of the RSE are again WRM, a port or router to landside operations and a specialized local safety processor with interface into the controller, e.g., Type 170 traffic signal controller.

Outside the WRM, the RSU may also include other potential principal components:

- DSRC amp and antenna
 - MCX coaxial DSRC antenna connector
- Other wireless transceivers: radio card plus amp and antenna (e.g., 802.11b/g)
 - MCX coaxial 802.11b/g antenna
- Connection to backhaul (e.g., 802.11-type wireless connection, (General Packet Radio Service or GPRS modem, hardware)
- Router/hub for network access and component integration
- Separate processor and/or connection to existing controller
 - Serial connector for intersection controller or other processor, as needed
- GPS for positioning and UTC time synchronization
 - Including MCX coaxial GPS antenna connector

- Power
 - 110 Volt power
 - AC to DC power supply
- Connection point for ground
- Separate enclosure (potential): tradeoff between Type 332 cabinets or additional watertight unit

This is a joint PATH and Caltrans activity. The above list of components is not yet complete; therefore, RSU components and configuration will be defined by PATH in conjunction with other *VII California* stakeholders.

5.2 Functions Performed

Development and Prototyping

This is a joint PATH and Caltrans activity, with significant stakeholder input. PATH will acquire and install a Type 332A cabinet and associated hardware at the University of California Richmond Field Station (RFS) “intelligent intersection” facility. The 332A cabinet is commonly found at Caltrans intersections and roadsides and will serve as a prototype unit. From this unit, stakeholders will have access to nominal RSU to develop their interfaces.

Specific prototype development directions will include:

- a. Design of autonomous processors for each RSU to allow minimal existing infrastructure modification. This will necessitate a robust computational platform, most likely a PC/104.
- b. Design of DSRC antenna and WRM integrated as transceiver subsystem for optimal performance and installation ease, connected by ethernet to processor. Prior antenna design has not been optimized for RSU.
- c. 802.11b/g amplifier and antenna coupled to the processor, in anticipation of a collateral requirement that will require provision of WiFi functionality for some VII services.
- d. GPRS serial port modem connection to processor for backhaul connection, for data as well as RSU maintenance purposes.
- e. Disk storage, with requirement heavily dependent on use case development.
- f. Embedded operating system for real-time communication response and small software footprint. While at this (ConOps) stage, design options are open; because VII involves safety-critical applications, we will likely eschew the use of MS Windows, opting for a reliable, robust RTOS.

Installation

This will be a Caltrans activity, supported by PATH. Documentation will be developed to show prototype RSU design and bill of materials, to include antennae, WAVE radios and PC/104 processors in order to replicate basic elements of the RFS prototype. At Caltrans’ discretion, Caltrans and PATH will implement the first 1 – 2 RSU locations, and Caltrans will implement the remaining testbed. There will be many site-specific considerations in applying RSUs, e.g., antenna placement and optimization, varying amounts available space within cabinets. Hence,

while our prototyping may specify the basic configuration, the field application will require work and ingenuity from our Caltrans partners.

Maintenance

This will be a Caltrans activity, supported by PATH for troubleshooting consultation.

Archiving

Data archiving will not be a requirement of the roadside components. All archiving will be a center-based activity.

6.0 Roadside-Center(s) Component

This component of the architecture is often referred to as the backhaul communications system. The national deployment of the backhaul communications system for VII may involve the participation of the telecommunications industry which would provide the necessary bandwidth and technology as part of a public/private partnership arrangement. The *VII California* testbed will be designed to offer opportunities for testing of various technological and institutional arrangements.

The initial *VII California* architecture deployed for the World Congress will enable data that has been sent by participating vehicles to the roadside units to be communicated to various destinations, including the 511/TravInfo[®] TIC and participating OEM processing centers, and enable travel time and incident data from the 511/TravInfo[®] system to be communicated to the roadside units. Because relatively few vehicles will be participating, and for expediency reasons, an existing GPRS communications system will likely be the primary medium to be used to provide for the two-way transmission of data among the 511/TravInfo[®] TIC, OEMs and the roadside units. Demonstration of a high bandwidth solution at a select RSU site will be investigated for the World Congress. Remote monitoring (center-based) of roadside units and the supporting network will not be an element of the World Congress demo but will be included in the subsequent testbed infrastructure.

This is an MTC-led activity. The requirements for the backhaul communications for the initial *VII California* architecture to be implemented for the World Congress will be developed by PB Farradyne with the participation of PATH. PB Farradyne will investigate the suitability of the existing GPRS communications system, and explore alternatives should the existing GPRS system not be suitable. PB Farradyne will make the necessary arrangements to ensure that the selected communications system is available in sufficient time prior to the World Congress for testing activities. The maintenance of the GPRS network will be administered by PB Farradyne. If another communications solution is implemented, maintenance will be accounted for in the procurement.

7.0 Processing and Archiving

The availability of the vast amounts of data that VII will ultimately make available will support a wide variety of applications that will enable enhanced or new governmental or commercial services. The continuing development and testing of VII will include the development and testing of these applications. The *VII California* testbed will be available for this purpose.

The initial *VII California* architecture will include data processing and archiving capabilities. These capabilities will enable the following operations with the *VII California* probe vehicle fleet:

- Processing the location, direction, time and speed data received from the participating vehicles to calculate travel times between adjoining roadside unit locations, and other link travel times
- Archiving all the location, direction, time and speed data received from the participating vehicles such that it can be used for evaluation and research purposes. For the World Congress demo, data archiving will be implemented for only data directed to the 511/TravInfo[®] system

The 511/TravInfo[®] system will also be leveraged into the *VII California* probe vehicles; travel time and incident information of relevance to the locations(s) of the RSUs from the 511/TravInfo[®] system will be sent to the roadside units for transmission to the participating vehicles and drivers.

This is an MTC-led activity. The software that enables the functions defined for the initial World Congress *VII California* implementation will be developed and/or integrated by PB Farradyne, which will be responsible for their design, development or acquisition, testing and maintenance, and the documentation of same.

8.0 Evaluation Plan

This is an MTC-led activity, with some coordination from the PATH, as PATH is the Caltrans-sponsored evaluator of the World Congress Innovative Corridors Initiative. Additional inputs will come from *VII California* stakeholders and participants, as technical data and operational know-how will be produced from the present effort.

The evaluation will be conducted in two steps: an initial evaluation after the World Congress, and a final evaluation at the conclusion of the VII California testbed development in 2007.

8.1 Initial Evaluation

The initial evaluation will commence shortly after the World Congress and is intended to produce lessons learned, in essence, to build a better test bed. In many respects, it will come at an ideal time – after the first, quick iteration where initial installation and operation are key but before the second, more studied iteration where long-range objectives take over. The focus will be on what is learned and some of the important questions asked in the evaluation will include:

- Did technology perform as desired?
- What were the limitations/constraints observed?
- Was there VII California interoperability with the privately-led World Congress Innovative Mobility Showcase?
- How successful was the organizational/management structure?
- Are demonstration outcomes extensible to a larger-scale and longer-term test setting?

These types of questions portend technical, institutional and process improvements for the subsequent testbed and will allow *VII California* to expand in scope, participants, stakeholders, and quality based on valuable lessons learned for a “quick strike” initial deployment.

8.2 Final Evaluation

The final evaluation will include technical, impact, and institutional analysis, and, where appropriate, should include before and after analysis. The full evaluation of the use cases could include agency and industry partner interviews regarding institutional and technical issues, surveys, observational analysis, interviews, and focus groups. The methodology to evaluate each use case will depend on the specific attributes of the technology and the persons exposed to the technology. For all use cases, technical, impact, and institutional variables will be assessed as appropriate.

Technical: The technical evaluation should focus on the hardware and software operation of the demonstration. Did the technology perform as expected/desired? Consideration should be given to: identification of key stakeholder partners; eliciting from the partners a meaningful set of goals and objectives for the project and their relative priorities; identifying and obtaining insight and consensus regarding which measures will indicate the degree to which project success has been achieved; and communicating changes in goals, objectives, and measures as the project progresses.

Impact: Impacts on VMT, safety, mobility, mode choice, transportation system efficiency, productivity of transportation providers, air quality, energy efficiency, etc. may be examined, as appropriate. Performance measures and corresponding metrics would be identified for study. Measures could include: reduction in the overall rate of crashes; reduction in delay; improvement in customer satisfaction; increases in freeway and arterial throughput or effective capacity; decrease in emissions levels; decrease in energy consumption; and cost savings. The level of detail and the opportunity to complete before and after analysis will be determined to a large extent by the size and duration of each use case. If the demonstration size is too small it may not be possible to study some of the broader societal impacts.

Institutional: Researchers would document lessons learned regarding institutional (State and Federal) challenges (what worked and what didn’t) and make recommendations for improvements (both institutional and procedural). This evaluation would also include a broader assessment of lessons learned regarding the public-public and public-private relationships for VII deployment.

Broadly these three evaluation components (technical, impact, and institutional) should culminate in policy recommendations for the direction of further VII California deployments, and relationships among agencies and between agency and industry, including institutional challenges, recommended solutions, and next steps.

Appendix B

DSRC-Enabled RoadSide Equipment (RSEs)

	Route	Cross Street
1	101 N	University Avenue (Palo Alto)
2	101 N	San Antonio Road (Palo Alto)
3	I-280 S	18th Street (San Francisco) *
4	SR 82	Page Mill (Palo Alto)
5	SR 82	California Avenue (Palo Alto)
6	SR 82	Curtner (Palo Alto)
7	SR 82	Charleston (Palo Alto)
8	SR 82	Quarry Road (Palo Alto)
9	SR 82	Stanford Avenue (Palo Alto)
10	SR 82	Sand Hill (Palo Alto)

*Outside Testbed Area